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Research Article

The effects of perceived distributed leadership on teacher professional development among primary school teachers: The mediating role of teacher professional learning community

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In the new context of comprehensively deepening education reform and school management oriented towards distributed leadership, analyzing the influencing factors of teachers' professional development to improve teachers' professional development is of great significance in strengthening the construction of the teaching force and promoting the high-quality development of education. Based on the theory of distributed leadership, this study used the Distributed Leadership Scale, the Teacher Professional Learning Community Scale, and the Teacher Professional Development Scale. A convenient sampling method was used to distribute questionnaires to 650 teachers in 33 primary schools in Hebei Province, China, and 593 valid questionnaires were collected. The structural equation model was employed to explore the relationships among distributed leadership, teacher professional learning communities, and teachers' professional development. The research results indicate that both distributed leadership and teacher professional learning communities can positively predict teacher professional development, and distributed leadership can positively predict teacher professional learning communities; The teacher professional learning community plays a completely mediating role between distributed leadership and teacher professional development.

Keywords: Distributed leadership; Teacher professional development; Teacher professional learning community

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1. Introduction

Teacher professional development can enhance teachers' efficiency through continuous personal development and collective improvement (Bowman et al., 2022), impacting teaching quality (Choi & Mao, 2021), influencing students' academic performance (Gore et al., 2021), and promoting school improvement (Gong, 2018). In China, basic education holds a fundamental and pioneering position in the national education system, with 15.86 million basic education teachers, accounting for 86% of the total number of full-time teachers. Promoting the professional development of primary school teachers and shaping a high-quality professional team of primary school teachers are crucial for accelerating the establishment of a high-quality education system and running basic

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education effectively (Ministry of Education, 2022). Therefore, various levels of government and educational departments in China have introduced a series of policies and measures to support the professional development of primary school teachers. Taking Hebei Province as an example, as a major province in basic education in China, by the end of 2021, Hebei Province had a total of 11,604 ordinary primary schools and 412,528 full-time primary school teachers (Hebei Provincial Bureau of Statistics, 2022). Policies and measures such as the "14th Five-Year Plan for Educational Development in Hebei Province" and the "Action Plan for Building a Strong Province in Education (2023-2027)" ensure and promote the professional development of primary school teachers in various aspects. However, primary school teachers in Hebei Province still face challenges such as heavy workloads, lack of clear career planning, inability of professional knowledge and skills structure to meet the needs of new curriculum reforms, insufficient mastery of teaching technology, and wavering professional beliefs (Gao, 2020), impacting the path quality of professional development of primary school teachers in the region. Therefore, this study focuses on primary school teachers in Hebei Province, analyzing the influencing factors of primary school teachers' professional development in the hope of contributing to the improvement of the professional development level of primary school teachers in Hebei Province.

Effective principal leadership is crucial for school transformation and teacher instructional improvement (Gong, 2018). However, with the continuous advancement of educational reforms and modernization, the traditional autocratic leadership model is increasingly inadequate for meeting the requirements of modern school management (Liu et al., 2022). More and more educators are viewing leadership from a distributed perspective (Spillane, 2005). Distributed leadership is essential in identifying potential leaders, creating leadership opportunities for teachers, facilitating teacher role transitions, and providing ongoing support for teachers (Amzat et al., 2022; Klar et al., 2016; Sebastian et al., 2016).TALIS 2018 research report shows that teachers' professional development is facilitated by the distributed leadership environment implemented by the principal - collaborative teamwork, autonomous decision-making and leadership practices(OECD, 2020). Poekert (2016) also found that in schools implementing distributed leadership, power, responsibility, and activity sharing, teachers tend to perform better.

According to the theory of distributed leadership, it cannot be imposed or delegated (Hard et al., 2013), but rather has an impact through a complex combination of collaborative learning opportunities and dynamic professional relationships (Aubrey et al., 2013). A teacher professional learning community is a group of teachers who collaborate, and support each other in learning, researching, practicing, and reflecting in a cooperative manner to continuously improve educational practices (Schmoker, 2005). The formation of teacher professional learning communities depends on the development of personal and professional relationships within the school, as well as the evolution of a set of values and understandings that guide actions. Distributed leadership, present in formal and informal roles, plays a crucial role in nurturing these relationships and developing shared values. In environments with widely distributed horizontal leadership structures, a culture of collaboration and shared decision-making emerges, leading to more sustainable knowledge and experience transfer. Distributed leadership empowers influential teachers in the team with professional knowledge, teaching, and research abilities, creating supportive conditions and relationships, shaping a culture of collaborative learning and trust, and developing and sustaining professional learning communities. Shared leadership and responsibility among team members in teacher professional learning communities contribute to enhancing open dialogue and teacher efficacy, building emotional bonds, strengthening teachers' professional spirit, and continuous professional learning that enhances teacher capabilities.

Since the emergence of distributed leadership, a rich theoretical system has been established, providing a theoretical basis for this study. However, educational theories always need to be validated and improved in various cultural backgrounds and school environments (Joo, 2020). With the updating of school management models and the advancement of the process of educational democratization, the practical demand for distributed leadership in Chinese schools

continues to grow (Zhao, 2016). Despite the significant impact of distributed leadership in educational leadership research and practice in Europe and America, its theoretical and practical value has not been fully realized in the context of Chinese educational leadership (Gong, 2023). Currently, research on distributed leadership in China is mostly focused on theoretical construction and conceptual advocacy, with limited empirical studies (Liu & Werblow, 2019; Lu & Smith, 2021; Xiu et al., 2022). Therefore, this study aims to: first, explore the impact of primary school principals' distributed leadership on the professional development of primary school teachers based on the Chinese context; second, based on distributed leadership theory, investigate the mediating role of primary school principals' distributed leadership in influencing the professional development of primary school teachers through teacher professional learning communities in the Chinese context, enriching empirical research on distributed leadership theory in China and providing strategic reference for promoting the professional development of primary school teachers.

2. Literature Review and Research Hypotheses

2.1. The Relationship between Distributed Leadership and Teacher Professional Development

Spillane (2005) argues that distributed leadership is an interactive process among leaders, followers, and situations in which leadership functions in schools are rotated or shared by multiple members based on organizational common goals and tasks. Leadership influence stems from extensive professional knowledge and outstanding skills (Zhu & Zhu, 2022), creating an environment where power and responsibility are shared (Amzat et al., 2022). It empowers teachers to collectively take responsibility and participate in school decision-making (Zheng & Yin, 2015), enhancing members' leadership capabilities through empowerment, fostering opportunities for mutual learning among members through collaborative sharing of professional knowledge, and effective teaching practices and strategies (Hermann, 2016). This leads to teachers' recognition and following of leaders with professional knowledge or skills, promoting mutual assistance and guidance for individual and group professional development among teachers (Zhao, 2016). Amzat et al. (2022) confirmed in an empirical study in schools in Jakarta, Indonesia, that implementing distributed leadership can enhance teachers' professional development. When power is distributed and shared in schools, teachers are confident, supported, and authorized to do their best in cooperation and social interactions, often performing well and improving their performance to ensure learning progress and student success. Based on this, hypothesis H1 is proposed:

H1: Primary school distributed leadership has a positive impact on teachers' professional development.

2.2. The Relationship between Distributed Leadership and Teacher Professional Learning Community

Distributed leadership plays an important role in initiating, implementing, and maintaining professional learning communities (Van Den Boom Muilenburg et al., 2021). Under distributed leadership, schools have multiple leaders and leadership activities that are widely shared within and between organizations (Harris, 2007; Spillane et al., 2004). When principals give up a certain degree of control and provide more teachers with the opportunity to take on a series of leadership roles related to achieving teaching and learning changes (Bolam et al., 2005), the leadership ability of professional knowledge is also recognized, and teachers will be more proactive and in-depth in internalizing school improvement goals and improving student performance as common goals and responsibilities, coordinating efforts, establishing consistent structures and procedures to support collective dialogue, And shaping a school culture of trust and collaborative learning (Van den Boom Muilenburg et al., 2021), based on collective beliefs, focusing on student learning and achievement, can help develop a teacher professional learning community (Mawhinney et al., 2005). In addition, distributed leadership has also been found to form positive relationships within professional learning communities (Hamzah & Jamil, 2019). Distributed leadership can establish a

culture of trust and collaborative learning, strengthen emotional bonds among team members, enhance internal cohesion, and successfully implement professional learning communities (Day & Sammons, 2013). Based on this, hypothesis H2 is proposed:

H2: Distributed leadership in primary schools has a positive impact on the professional learning community of teachers.

2.3. The Relationship between Teacher Professional Learning Community and Teacher Professional Development

Teacher professional development is essentially a process of continuous learning and construction by teachers (Widodo & Allamnakhrah, 2020). A community of teacher professional learning shapes emotional bonds, mutual trust, respect, and inclusive school culture through widely shared beliefs among teachers (Meeuwen et al., 2020), providing a supportive, emotional, and safe environment for teacher professional development; it also indicates the professional direction for teachers: a common vision, shared responsibility, mutual focus on student learning, and ongoing teacher learning (Meeuwen et al., 2020). Through collaboration, reflection, giving and receiving feedback, and experimentation, individual and collective learning is promoted (Meirink et al., 2010). It is evident that the purpose of teacher professional learning communities is to focus on cooperation, sharing in non-traditional ways, enabling teachers to view colleagues as learning partners and contribute to each other's professional learning through interaction, dialogue, feedback, and reflection (Nicholas et al., 2018), addressing the social, professional, and personal needs of its members, fostering their own and others' professional development (Vangrieken et al., 2017). Prenger et al. (2019) studied the impact of 23 network professional learning communities in the Netherlands using a mixed-method approach, showing that teacher participation in network professional learning communities significantly enhances teachers' knowledge, skills, and work attitudes, promoting teacher professional development. Based on this, hypothesis H3 is proposed:

H3: Teacher professional learning communities have a positive impact on teacher professional development.

2.4. The Mediating Role of Teacher Professional Learning Communities

According to the theory of distributed leadership, leadership practice is realized and developed through situations, where leaders influence followers through the context (Heck & Hallinger, 2009; Spillane, 2005; Wenger, 1999). Leaders construct vision goals, cultivate school culture, share power, and responsibility, and focus on leadership practice (Elmore, 2000; Heck & Hallinger, 2009; Spillane et al., 2004). These attributes and characteristics establish the distribution of leadership energy in a systematically supportive school environment - professional learning communities for teachers, thereby meeting teachers' developmental needs, significantly improving teaching abilities, professional learning, professional spirit, and positive behaviors (Amzat et al., 2022; Colmer, 2017). Principals promote teacher participation in school management through distributed leadership, fostering a collaborative work environment and a positive collective culture that can enhance the development of professional learning communities for teachers, which emerge based on individual teacher needs within the organization (Wenger, 1999). When professional learning communities for teachers serve as organizational working conditions, they focus on enhancing educational activities involving teaching and learning, directly influencing teachers' professional levels and key teaching behaviors (Anthony et al., 2019). Joo (2020) research indicates that distributed leadership significantly impacts teachers' professionalism through the mediating effect of professional learning communities for teachers. Based on this, hypothesis H4 is proposed:

H4: Professional learning communities for teachers have a mediating effect between distributed leadership and teachers' professional development in elementary schools.

3. Method

3.1. Sample

This study utilized convenience sampling to select a total of 650 questionnaires distributed to 33 primary schools in Hebei Province. According to the principle of Moser and Kalton (2017), invalid questionnaires such as incomplete answers and outliers were deleted. After eliminating invalid questionnaires, 593 valid responses were collected, resulting in an effective response rate of 91.23%. The background variables in this study included the gender and teaching experience of primary school teachers. Among the gender variables, there were 352 female teachers (59.4%) and 241 male teachers (40.6%). In terms of teaching experience, there were 183 teachers with 1-5 years (30.9%), 99 teachers with 6-10 years (16.7%), 66 teachers with 11-20 years (11.1%), and 245 teachers with over 21 years (41.3%).

3.2. Research Tools

3.2.1. Distributed Leadership Scale

This study utilized the Distributed Leadership Scale developed by Özer and Beycioğlu (2013). Because the scale measures distributed leadership from the perspective of teacher perception, the subjects selected are also consistent with the subjects of our study, that is, primary school teachers. In addition, the concept of distributed leadership adopted in the study is also the concept of Spillane (2005), which is consistent with our study. The scale employs a 5-point Likert scoring method, with 1-5 indicating "Never" to "Always". It is a single-factor structure consisting of a total of 10 items. In this study, the Cronbach's Alpha coefficient of the scale was .946. The results of the confirmatory factor analysis indicate that the fit indices for structural validity are all within an acceptable range (χ^2/df = 10.190; GFI = .893, AGFI = .831, NFI = .927, all greater than .800; SRMR = .040, RMSEA = .073, both less than .080; RFI = .906, CFI = .934, and IFI = .934, all greater than .900; PNFI = .721, PGFI = .568, both greater than .500). The composite reliability [CR] of the convergent validity is .948, meeting the assessment standard of above .700 (Hair, 1998). The average variance extracted [AVE] is .646, meeting the assessment standard of above .500 (Wu, 2010).

3.2.2. Teacher Professional Learning Community Scale

This study utilized the revised Teacher Professional Learning Community Scale by Vanblaere and Devos (2016), because the survey subjects of this scale are also primary school teachers, which is consistent with the research subjects of our study, and the model has been verified to achieve satisfactory model fit. The scale consists of 11 items categorized into three dimensions: collective responsibility, depersonalization practices, and reflective dialogue. The Cronbach's Alpha values for each dimension were .846, .740, and .881 respectively, with a total scale reliability of .893. Confirmatory factor analysis results indicated acceptable fit indices (χ^2/df = 7.455, GFI = .900, AGFI = .938, NFI = .913, all above .800; SRMR = .048, below .080; RFI = .903, CFI = .923, and IFI = .924, all above .900; PNFI = .680, PGFI = .559, both above .500). The composite reliability for convergent validity was .851 for collective responsibility, .751 for depersonalization practices, and .884 for reflective dialogue, meeting the criteria of .700 or higher (Hair, 1998). The average variance extracted was .658 for collective responsibility, .506 for depersonalization practices, and .604 for reflective dialogue, all exceeding the .500 standard (Wu, 2010).

3.2.3. Teacher Professional Development Scale

This study utilized the Teacher Professional Development Scale developed by Qiu and Xiao (2019), because the definition of teacher professional development in this questionnaire is consistent with the connotation of teacher professional development in our study. The scale consists of 12 items categorized into three dimensions: Professional Attitude Fulfillment, Professional Function Enrichment, and Professional Autonomy Implementation. The total scale's Cronbach's Alpha coefficient is .932, with individual dimension Cronbach's Alpha coefficients of .934, .883, and .840

respectively. Measurement was conducted using a six-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree" with scores from 1 to 6, where higher scores indicate a higher level of teacher professional development. Results from confirmatory factor analysis indicated that the fit indices were within an acceptable range (χ^2/df = 8.882, GFI = .882, AGFI = .819, NFI = .924, all above .800; SRMR = .064, below .080; RFI = .902, CFI = .932, and IFI = .932, all above .900; PNFI = .714, PGFI = .577, both above .500). In terms of convergent validity, the composite reliabilities for the latent variables were .934 for Professional Attitude Fulfillment, .893 for Professional Function Enrichment, and .850 for Professional Autonomy Implementation, all meeting the assessment standard of above .700 (Hair, 1998). The average variance extracted was .740 for Professional Attitude Fulfillment, .677 for Professional Function Enrichment, and .655 for Professional Autonomy Implementation, meeting the assessment standard of above .500 (Wu, 2010).

3.3. Data Analysis

Based on the theory of distributed leadership, this study uses SPSS.26 and AMOS tools, takes the teacher professional learning community as the mediating variable, and adopts the structural equation model to explore the impact of primary school teachers' perception of the principal's distributed leadership on the teacher's professional development. First, through the main effect model test results, it is concluded that primary school teachers' perception of the principal's distributed leadership can have a positive and significant impact on the teacher's professional development; then, on the basis of the main effect model, the mediating role of the teacher's professional learning community is further tested. The results have been presented in the following section.

4. Results

4.1. Common Method Variance Test

This study used exploratory factor analysis to conduct Harman's single-factor test, analyzing all items in the questionnaire. Based on a Kaiser-Meyer-Olkin (KMO) value greater than .800 and a significant Bartlett's sphericity test with $p < .001$, it was observed that the number of factors with eigenvalues greater than 1 exceeded 1. Additionally, the criterion for the maximum factor variance explained should be less than 40% (Zhou & Long, 2004). This was done to detect common method variance. As shown in Table 1, the KMO value was .944, exceeding the reference value of .800, and the Bartlett's sphericity test was significant with $p < .001$. Five factors with eigenvalues greater than 1 were extracted, with the first factor explaining 21.381% of the variance, below the 40% reference value, meeting the criteria. Therefore, it can be concluded that there is no common method variance in the data of the official questionnaire in this study, allowing for the continuation of the subsequent data analysis.

Table 1
Common method variance test

Factor	*Eigenvalues（≥）1*	*Explained variance*	*Total variance explained*
1	7.056	21.381	21.381
2	6.012	18.217	39.598
3	4.626	14.019	53.617
4	3.209	9.724	63.340
5	1.958	5.935	69.275
KMO：.944			
Bartlett's sphericity test is significant $p <$ .001			

Note. The data source is compiled by this study.

4.2. Correlation Analysis

This study conducted a correlation analysis of three variables, as shown in Table 2. The correlation coefficients between the variables range from .415 to .536, all of which are positively significant (p < .001). This indicates a significant positive correlation among distributed leadership, teacher professional learning communities, and teacher professional development.

Table 2
Correlation Analysis of Variables

Variables	*M*	*SD*	*DL*	*PLC*	*TPD*
DL	4.0546	.836	1		
PLC	3.7785	.618	.536***	1	
TPD	5.2132	.649	.415***	.481***	1

Note. DL=Distributed Leadership, PLC=Teacher Professional Learning Community, TPD=Teacher Professional Development, M is the average, SD is the standard deviation; ***p < .001.

4.3. Structural Equation Model Analysis

This study examines the mediating effect of a professional learning community among teachers, with elementary school teachers' perception of distributed leadership by principals as the independent variable and teachers' professional development as the dependent variable, using a structural equation model. Following the Baron and Kenny (1986) procedure for testing mediating effects, the study first tests the main effect model and then examines the mediating role of the professional learning community between elementary school teachers' perception of distributed leadership by principals and teachers' professional development.

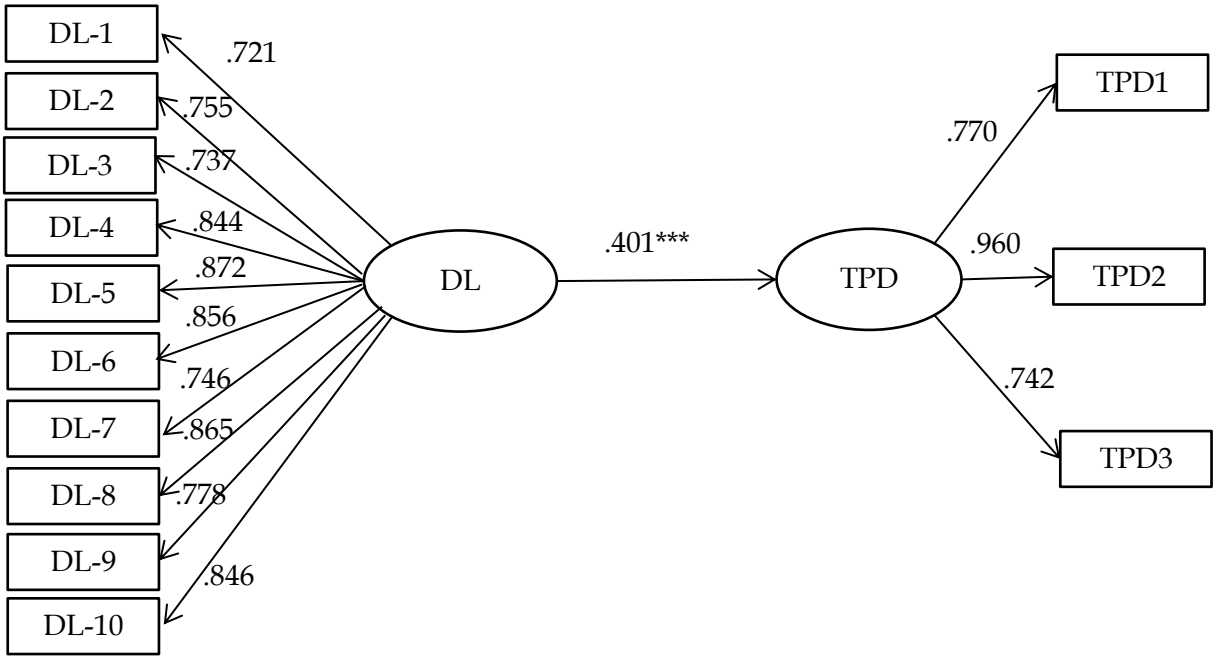
4.3.1. Main Effect Model

To examine the main effect of elementary school teachers' perception of distributed leadership by principals on teachers' professional development, a structural model was established (see Figure 1). The model fit indices are as follows: χ^2/df = 7.595. When χ^2/df is greater than 5, it is necessary to refer to other fit indices for evaluation (Wheaton, 1987). Other fit indices include SRMR = .050, below the standard value of .080, GFI = .885, AGFI = .837, NFI = .919, all above .800 (Doll et al., 1994; MacCallum & Hong, 1997; Ullman, 2001); RFI = .902, CFI = .929, IFI = .929, all above .900 (Bollen, 1989), PNFI = .754, PGFI = .623, both above .500 (Mulaik et al., 1989), indicating a good model fit. In the structural model shown in Figure 1, the path coefficient of the main effect of distributed leadership on teachers' professional development is .401 (p < .001), reaching a significant level, indicating that distributed leadership can positively influence teachers' professional development. Therefore, hypothesis H1 of this study is supported.

4.3.2. Analysis of Overall Path Model

Building upon the main effects model, further examination was conducted to test the mediating role of teacher professional learning communities between distributed leadership and teacher professional development. Initially, the structural model consisting of distributed leadership, teacher professional learning communities, and teacher professional development was tested for fit. The results are as follows: χ^2/df = 6.549. When χ^2/df is greater than 5, other fit indices need to be considered for evaluation (Wheaton, 1987). Other fit indices, SRMR = .062, below the standard value of .080, GFI = .871, AGFI = .827, NFI = .905, all exceeding .800 (Doll et al., 1994; MacCallum & Hong, 1997; Ullman, 2001); RFI = .901, CFI = .918, IFI = .918, all exceeding .900 (Bollen, 1989), PNFI = .762, PGFI = .647, both exceeding .500 (Mulaik et al., 1989). These results indicate a good fit of the structural model.

Figure 1
Main Effects Path Diagram



Note. DL=Distributed Leadership, PLC=Teacher Professional Learning Community, TPD=Teacher Professional Development.

Based on the results of the structural equation model analysis, as shown in Figure 2 and Table 3: distributed leadership has a significant positive impact on teacher professional learning communities (β = .641, p < .001), supporting hypothesis H2; teacher professional learning communities have a significant positive impact on teacher professional development (β = .538, p < .001), supporting hypothesis H3. The direct effect path coefficient of distributed leadership on teacher professional development is .401 and reaches significance. However, the impact of distributed leadership on teacher professional development becomes non-significant after incorporating teacher professional learning communities between distributed leadership and teacher professional development.

According to the suggestion of Nevitt and Hancock (2001), Bootstrap can be further used to test the mediating effect of teacher professional learning communities. This study further used the bias corrected percentile Bootstrap method (repeated sampling 5000 times) to test the mediating effect, with a confidence interval set at 95%. If the 95% confidence interval contains 0, it indicates that there is no mediating effect; If the confidence interval does not include 0, it indicates a significant mediating effect (Hayes, 2013).

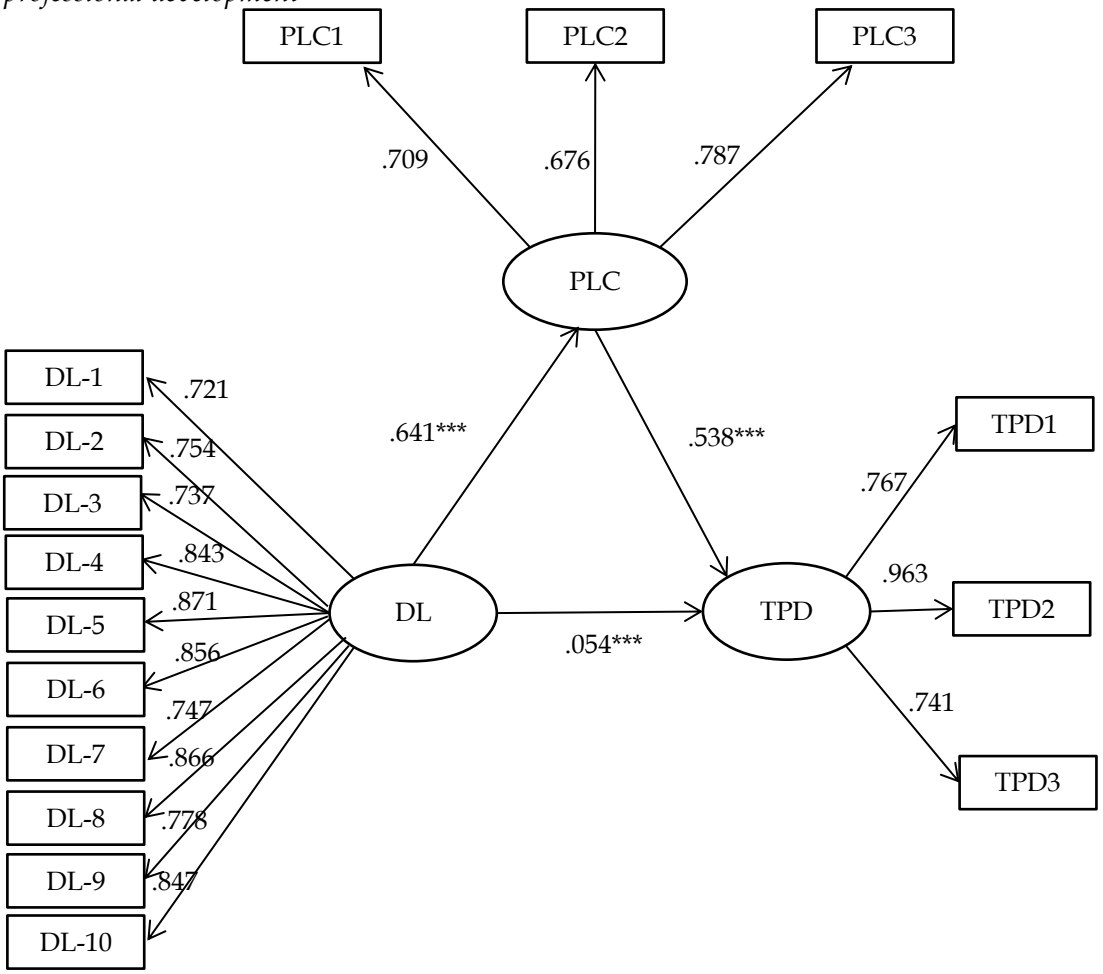
Based on Table 3, it can be seen that the indirect effect value of distributed leadership on teachers' professional development through teacher professional learning communities is .345, with a 95% confidence interval [.206, .546] that does not include 0, indicating a significant level and suggesting a mediating effect. The direct effect of distributed leadership on teachers' professional development with a 95% confidence interval [−.174, .253] that includes 0, indicates a non-significant direct effect, showing a complete mediating effect. Therefore, the teacher professional learning communities play a complete mediating role between distributed leadership and teachers' professional development, supporting hypothesis H4.

Table 3
Mediation Analysis in Bootstrap

Path	*Estimate*	*p*	*Confidence Interval (95%)*
Direct Effect			
Distributed Leadership → Teacher Professional Development	.054	.339	[-.174, .253]
Distributed Leadership → Teacher Professional Learning Community	.641	***	[.512, .767]
Teacher Professional Learning Community →Teacher Professional Development	.538	***	[.352, .750]
Indirect Effect			
Distributed Leadership → Teacher Professional Learning Community → Teacher Professional Development	.345	***	[.206, .546]
Total Effect			
Distributed Leadership → Teacher Professional Development	.399	***	[.299, .500]

Note: ***p < .001; The data source is compiled from this study.

Figure 2
Structural model diagram of distributed leadership, teacher professional learning community, and teacher professional development



Note. DL=Distributed Leadership, PLC=Teacher Professional Learning Community, TPD=Teacher Professional Development.

5. Discussion

5.1. The Impact of Distributed Leadership by Principals on Teacher Professional Development among Elementary School Teachers in Hebei Province, China

The results of this study indicate that the perceived distributed leadership of elementary school principals in Hebei Province has a significant positive impact on teachers' professional development. Therefore, research hypothesis H1 is supported, which is consistent with previous research findings (Amzat et al., 2022; Liu, 2017), indicating that the higher level of distributed leadership of principals, the higher level of teachers professional development. Distributed leadership transforms the values and ideas of the school into a common vision and creates an environment where power and responsibility are shared, teachers under this leadership model can enjoy more autonomy, a sense of responsibility, belonging, and resource support, which increases their sense of efficacy, stimulates their positive work attitudes, motivates them to exert greater effort and perseverance, and enhances teachers' professional knowledge and development of their teaching practices (Liu & Werblow, 2019).

5.2. The Impact of Distributed Leadership by Principals on Teacher Professional Learning Community among Elementary School Teachers in Hebei Province, China

The perception of principal distributed leadership by primary school teachers in Hebei Province has a significant positive impact on the professional learning community of teachers. Therefore, the hypothesis H2 is supported, which is consistent with previous research findings (Joo, 2020; Xiu et al., 2022). Distributed leadership plays a crucial role in developing and disseminating a shared vision, forming a culture of trust, and sharing power and responsibility. The vision and goals that principals strive to build are based on an understanding of the school's values, future direction, and student development, which in turn unite members and generate the motivation for practical goals. This is also the core and foundation of the professional learning community of teachers, focusing on collective responsibility. When principals implement distributed leadership, it is more conducive to fostering a school culture of trust, cooperation, and support, which are prerequisites for developing and sustaining a professional learning community of teachers (Wang, 2016).

5.3. The Impact of Teacher Professional Learning Community on Teacher Professional Development among Elementary School Teachers in Hebei Province, China

Elementary school teacher professional learning communities can positively predict teachers' professional development. Hypothesis H3 is supported, aligning with previous research views (Hilel & Ramírez-García, 2022; Joo, 2020). Teachers in professional learning communities take on collective responsibility, focusing their attention on the learning of all students (Hargreaves, 2007). This creates a collaborative culture of collective motivation for all teachers, avoiding isolated teaching (Wahlstrom & Louis, 2008). Collaborative activities are carried out through non-privatized practices and reflective dialogues, sharing practices with colleagues through peer guidance, team teaching, and mutual observation (Wahlstrom & Louis, 2008), leading to a deeper understanding of teaching and learning (Bryk et al., 1999). This fosters individual and collective learning, positively impacting teachers' skills, knowledge, beliefs, attitudes, and teaching behaviors (Opfer & Pedder, 2011).

5.4. The Mediating Role of the Professional Learning Community for Primary School Teachers in Hebei Province, China

The research results indicate that the professional learning community of primary school teachers in Hebei Province has a fully mediating effect between distributed leadership and teachers' professional development. Hypothesis H4 is supported, which is consistent with previous research perspectives (Joo, 2020; Wang, 2016; Xiu et al., 2022). Distributed leadership cultivates a culture of collaboration and empowers teachers with more power and responsibility, while aligning their personal goals with the school's mission and vision. Shared leadership and responsibility among

team members can enhance open dialogue and teacher effectiveness, thereby strengthening professionalism. Collaborative efforts from all parties to establish a coordinated structure to support collective inquiry and develop a culture of collaborative learning aim to build teachers' collective capacity (Bolam et al., 2005). Through a teacher professional learning community, principals can cultivate teacher leaders and promote the concept of teachers as agents of change. When teachers have the opportunity to establish reform initiatives and work together to lead development and change, the improvement of schools is more likely to occur, and the collective and individual abilities of teachers can be enhanced (Wang, 2016).

6. Suggestions

6.1. Principal Enhances their own Abilities and Implements Distributed Leadership

This study confirms the importance of distributed leadership in teacher professional development, emphasizing the need to provide teachers with autonomy and decision-making authority. For principals themselves, it is essential to enhance the implementation of distributed leadership within schools. Firstly, principals should genuinely value and trust teachers, empowering them based on their individual characteristics and professional situations, thus increasing opportunities for teachers to participate in school management. Secondly, principals should prioritize interpersonal interaction and communication, fostering a team atmosphere and school culture characterized by respect, trust, and openness. Actively seeking teachers' opinions in decision-making and planning processes is crucial in creating favorable external conditions for teachers to engage in school decision-making and management.

6.2. Establishing a Professional Learning Community for Teachers and Creating a Positive School Culture

This research indicates that distributed leadership can positively influence teacher professional learning communities, thereby enhancing the level of teachers' professional development. It is recommended that schools establish and enrich various forms of teacher professional learning communities. Firstly, principals should shape a campus culture of trust and respect, adopt participatory decision-making processes, make the school's common vision and development goals the collective responsibility of teachers, create a leadership-supported learning environment for teachers, and establish various models of teacher professional learning communities that are more teacher-driven. Secondly, there is a need to expand communication channels for teachers within learning communities, enhance teachers' own awareness and willingness to participate in teacher professional learning communities, increase communication among communities, promote professional dialogues, and facilitate the flourishing development of teacher professional learning communities.

7. Limitations and Prospects

This study measures the situation of principal's distributed leadership from the perspective of teachers' perceptions. The sample size of teachers is much larger than that of formal leaders, providing a certain advantage in terms of measurement scope. However, the data obtained from teachers' perceptions are subjective and lack direct data on the implementation of distributed leadership by formal leaders, which may lead to some errors in accurately presenting the situation of principal's distributed leadership. It is recommended that future researchers increase the measurement of principal's distributed leadership from the perspective of formal leaders. This approach can validate and complement the results from the teachers' perception perspective, leading to a deeper understanding of the relationship between distributed leadership at the teacher and school levels.

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Declaration of interest: The authors declare that no competing interests exist.

Ethical declaration: Authors declared that the study was approved by Dhurakij Pundit University on [02.08.2024] with the approval code [DPU-BSH 080267/2566].

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